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**V1**

(56) Documents cited  
**GB A 2108747 EP 0059318 EP 0042155**  
**WO 83/02188 US 4549867**

(58) Field of search  
**G5G**  
**Selected US specifications from IPC sub-class G09B**

(54) **Portable reading system for the visually handicapped**

(57) A reading system for the visually handicapped includes bar coded documents, a hand held device for scanning the bar codes, and means for converting the output of the device into synthesised speech. The bar codes are arranged in linear arrays (figure 3 — not shown) to facilitate scanning. Guiding devices to help the scanning device move over the arrays may be provided, as may tactile indications of the positions of the arrays.

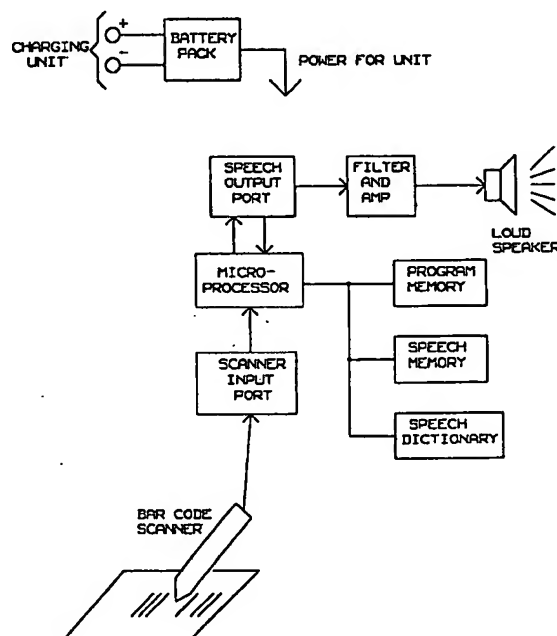


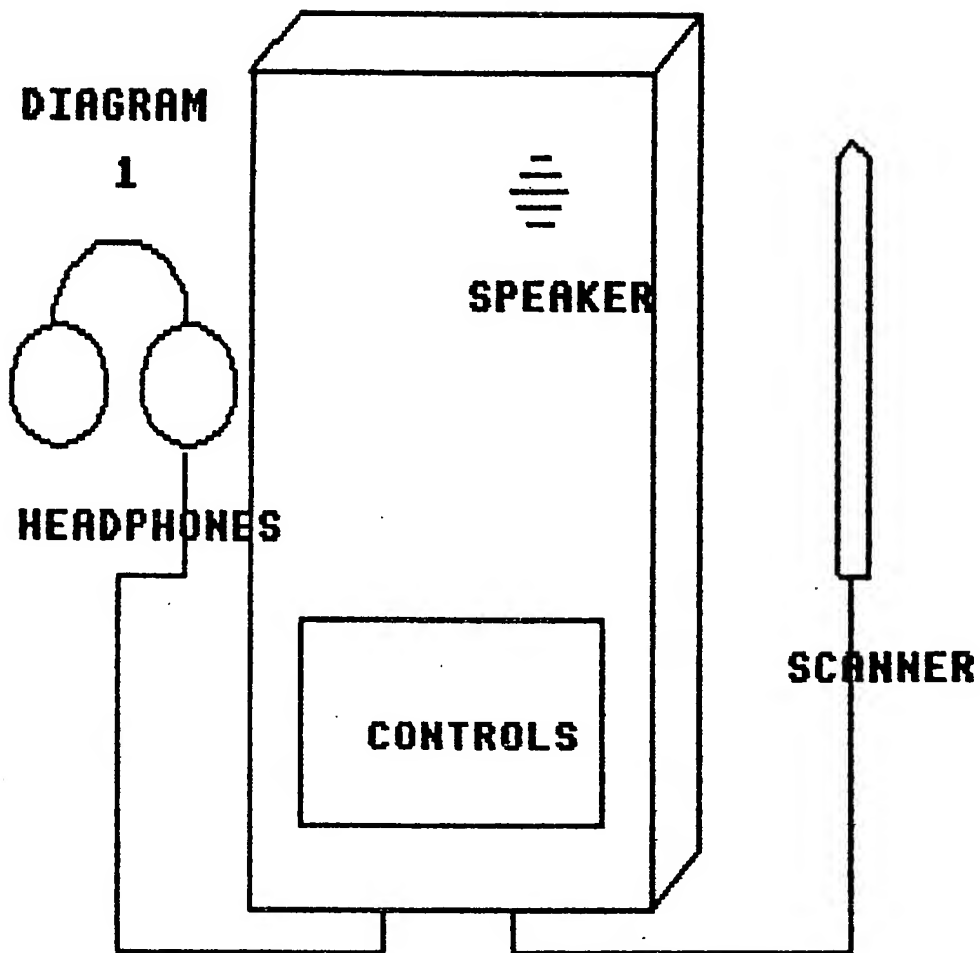
DIAGRAM 2

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**DIAGRAM**

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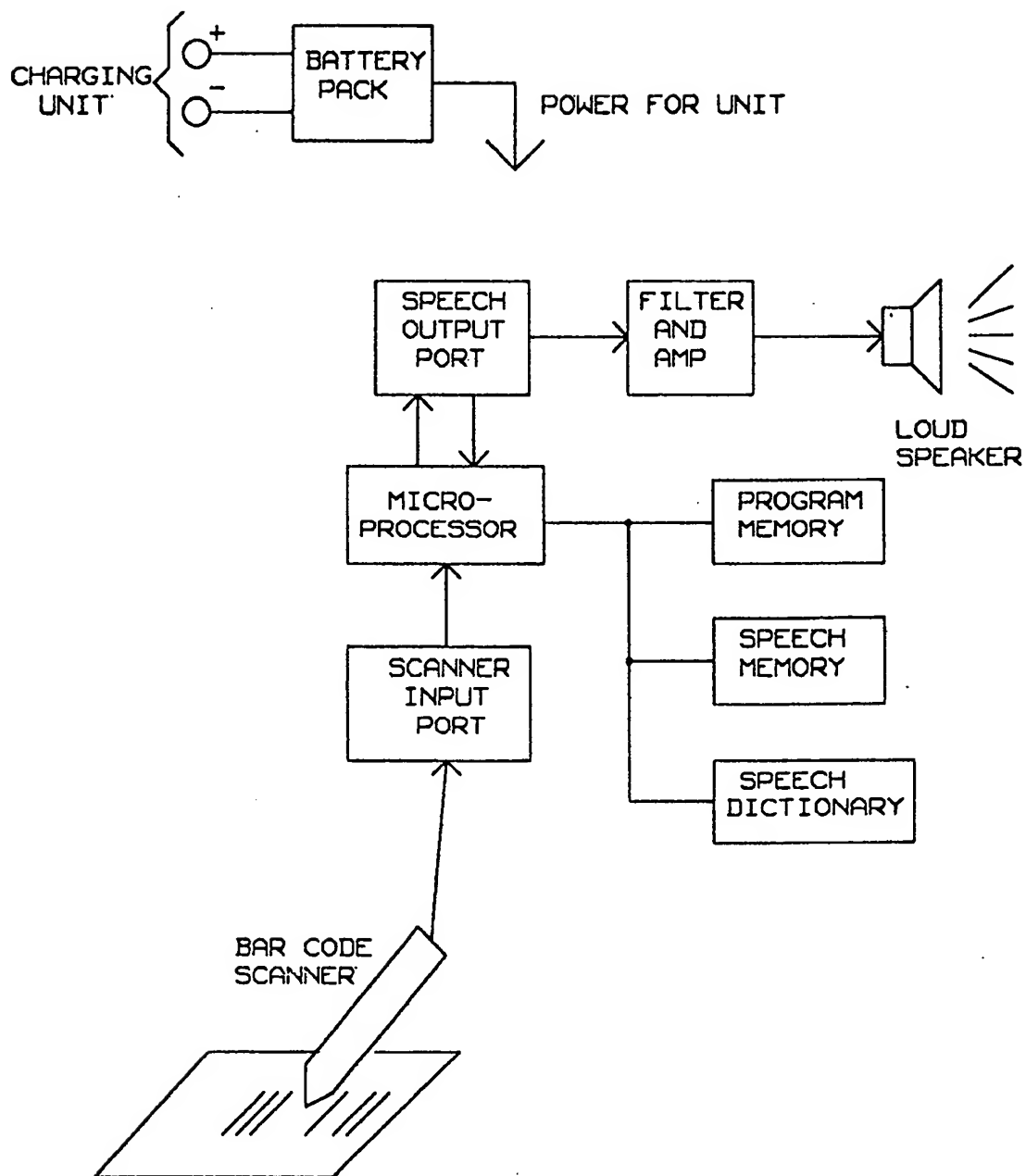


DIAGRAM 2

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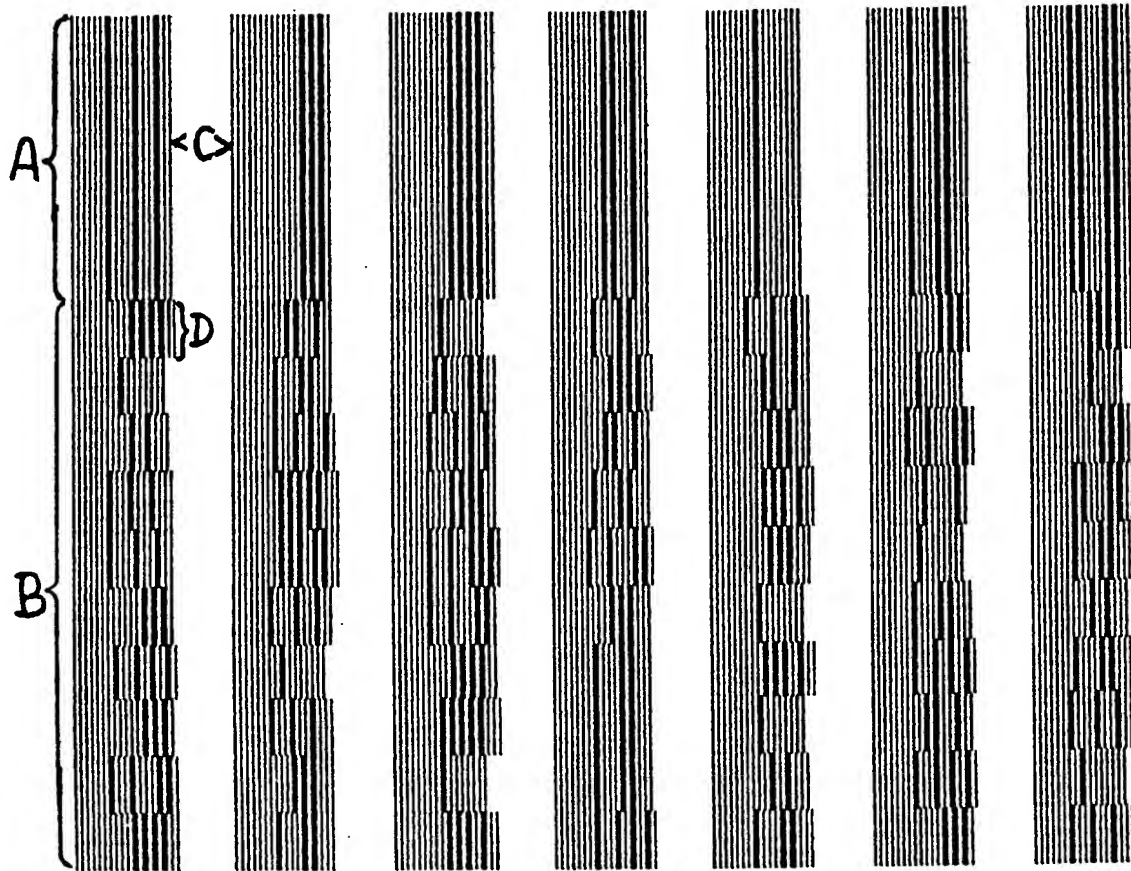


DIAGRAM 3

## SPECIFICATION

### A portable reading system for the visually handicapped

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This invention relates to a portable device to generate synthetic speech from information printed in bar code form and to the documents read by this device. The purpose of the invention is to provide a compact, portable and simple reading system for the visually handicapped.

The associated computer system required to produce the bar coded documents used by the system is also described briefly.

15 Systems currently available which provide visually handicapped people a means of reading include:-

1. TACTILE SYSTEMS such as Braille, which can be difficult to learn, use relatively bulky and fragile documents and require special means of document printing.

2. AUDIO TAPES, which are time consuming to record, use expensive media and reproduction equipment and are not very convenient for direct access to information or 'browsing'.

25 3. SPEECH FROM TEXT production systems, which require considerable accuracy in scanning the source text, achieved either by using expensive automatic text scanning equipment or by providing tactile feedback which enables a hand held scanner to be located on lines of text accurately.

This system provides an alternative means of generating synthetic speech from printed information which has the following advantages:-

1. Reduction of the scanning accuracy required from the user by comparison with text scanning systems, because bar codes are a one dimensional method of data representation.

2. Portability, since the reader is self contained and battery powered and similar in size to a personal stereo tape player.

3. Relative ease of learning and convenience in operation.

4. Production of document originals and copies by conventional printing and photocopying techniques.

45 5. The ability to provide audible feedback information if necessary to assist scanning of documents either by immediate output of each word scanned or by output of an audible signal to indicate that information exists in the area being scanned, without the need for an additional tactile feedback mechanism or mechanized scanning.

The complete system for document production and reading comprises:-

1. The portable device which generates synthetic speech from documents containing information held in bar coded form and which is provided to each user of the system.

2. A document production system which creates the required documents from text information held in computer readable form.

3. Bar coded documents, which are made available to users by any means whereby normal printed information is made available to sighted readers.

4. Scanner guidance devices to assist use of the system by visually handicapped users.

Descriptions of these four elements follow.

THE READING DEVICE, provided to individual visually handicapped users of the system, is illustrated in Diagram 1 (General Appearance) and Diagram 2 (Block Diagram) and incorporates:-

70 1. A bar code scanner.

2. Firmware to decode output from the bar code scanner into speech. This decoder includes a common word/phrase translation facility for decoding of information held in bar codes in compressed encoded form and has the ability to distinguish between bar codes in this form and directly encoded text or phonetic information and to decode each correctly.

3. A speech generation system to process the information generated by the decoder using a simple allophone based speech chip.

4. An audio output stage to provide speech via a loudspeaker and/or headphones.

5. An internal rechargeable power source and provision for connection to an external power supply.

6. Controls and adjustments to allow setting of the speed, volume, content and inflection of the speech output within the capabilities of the device as each user may require. These controls are designed for use by blind operators, providing tactile and/or audio indications of settings as appropriate. Speech content options include the ability to output or ignore punctuation and special symbols such as mathematical formulae where these are present in the document being scanned.

THE BAR CODED DOCUMENTS contain the input information for the reader device. The special features of these documents are shown in general terms in Diagram 3 and are as follows:-

100 1. Bar codes are not printed in conventional separate strips but touching the codes on adjacent lines. This ensures that an audible output is obtained from a scan at any point on the document provided only that the direction of scan is correct in relation to the alignment of the bar codes.

2. The depth of each bar code (D) is sufficient to allow many users to scan a bar code without exceeding the top and bottom edges of the bar code given a tactile means of locating the start of the bar code and identifying the required direction of scan. Where this cannot be achieved a guide device is used and the depth of bar codes is standardized to conform with the characteristics of such guide devices.

3. Synchronization markers (C) are included in the bar codes so that scans which do not start at the beginning of a bar code can be correctly decoded. These are depicted as wide gaps in Diagram 3 but may also take other forms such as a selected bar code character. These markers serve both to overcome scanning inaccuracies and to allow casual browsing of documents or inspection of information in list form.

4. Common words and phrases which are known to exist in the reader device translation table are bar coded as a short code. This allows a greater packing density of information in documents. Information which is not held in the translation table is encoded either as text or phoneme strings and control characters within the bar codes identify the mode of encoding.

130 5. Centrally produced documents such as maga-

zines newspapers or books are printed in a standard format, with area (A) provided for document title and reference, page number etc. and area (B) containing the document text. These different areas are always

- 5 located in the same position on the document so that the blind user can, with practice, quickly identify a document from the coded reference information provided as well as from the actual text contained in it. Title page, index and contents pages are included in a standard layout for multi-page document sets. These layout conventions can be ignored for informal use of the system such as letter writing and low volume information for restricted groups of users, provided the basic bar code and document dimensions and correct bar coding standard are observed.

- 15 Diagram 3 shows the general format and essential features of bar coded documents. It does not show the actual bar code data encoding system to be used in a working device or define the precise measurement of any feature shown.

The synchronization markers (C) illustrated as blank areas in bar codes may instead be a specific bar code character sequence in a working version of the document.

- 25 The unit depth of bar codes (D) is standard for all documents and matches the characteristics of each scanner guide device used. Deeper bars (e.g. area A) occupy a multiple of this unit depth.

- 30 GUIDANCE DEVICES allow the user to locate the start position of each bar code on a document and if necessary assist with the registration of the scanner while a scan is performed.

- The start position of each bar code is indicated in the case of bound document sets by perforating and binding documents with a suitable binder such that each row of bar codes is aligned with one spine of the binder. The binder then acts as the guide to the start of each bar code and has the advantage that as each page is turned the guide is immediately available. The guidance provided by this method is available for both sides of each document where duplex printing is used.

- For unbound documents a document holder is used in which the place of the binder is taken by a strip adjacent to the margin used for binding and containing tactile marks which indicate the start position of each row of bar codes.

For users who experience difficulty in following each bar code row accurately, assistance is provided by:-

- 50 1. A document holder as described above which also contains grooves aligned with each row of bar codes into which the scanner tip registers through the document so that a correct path can be followed easily.
- 55 2. A document holder which incorporates a cursor bar which can be moved in graduated steps which coincide with the depth of each bar code so that the scanner can be moved in contact with the cursor.
3. A template which overlays the document and incorporates slots which align with each code through which the scanner tip can be inserted.

- 60 Other guidance devices may be developed in the light of user experience. The device used by any individual is a matter of individual capability and preference.
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THE DOCUMENT PRODUCTION SYSTEM is largely outside the scope of this specification but is described briefly because it is an essential part of the complete reading system.

- 70 Document preparation is performed by software run on a suitable computer system which incorporates a synthetic speech output equivalent to that used in the reading device previously described and a printing device capable of generating master copies of documents as previously described. This system will include the rules of text compression for common words and phrases which are held in the reading device translation table, document formatting and index, title and contents page generation where required. Where possible this software will be provided in a form suitable for use by any organization or individual requiring to produce information in the form previously described.

- The system will be able to accept information for compilation into bar coded documents either by direct keyboard input or from an existing computer readable format.

#### CLAIMS

1. A reading device for the visually handicapped in which information in bar coded form is read by a hand-held scanner and converted into synthetic speech.

2. A device as claimed in Claim 1 incorporating an internal rechargeable power source and means of connection to an external charger in order to make the device fully portable.

3. A device as claimed in Claim 1 or Claim 2 incorporating controls suitable for use by a visually handicapped user which allow adjustment of attributes of the synthetic speech output as required by the user.

4. A device as claimed in any preceding claim in which is incorporated a means of translating information held in bar codes in compressed form into expanded words and phrases via an internal translation table and a means of recognizing sections of a bar coded document which are encoded in this form.

5. A device as claimed in any preceding claim in which is incorporated a means of generating speech output from text encoded character by character into bar coded form and a means of recognizing sections of a bar coded document which are encoded in this form.

6. A device as claimed in any preceding claim in which is incorporated a means of generating speech output from phonetic information encoded directly into bar coded form and a means of recognizing sections of a bar coded document which are encoded in this form.

7. A device as claimed in any preceding claim generally as shown in diagram 1.

8. A device as claimed in any preceding claim incorporating logic structure generally as shown in diagram 2.

9. A bar coded document format generally as shown in diagram 3.